

301A/301B/301C/301D/301E

Clamp Meter

Calibration Manual

January 2023 (English)

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Introduction

The Fluke 301A/301B/301C/301D/301E Clamp Meter (the Product or Clamp) measures ac and dc voltage, ac and dc current, resistance, continuity, diode, capacitance, and frequency. All illustrations show the 301B unless otherwise specified.

Contact Fluke

Fluke Corporation operates worldwide. For local contact information, go to our website: www.fluke.com.

To register your product, or to view, print, or download the latest manual or manual supplement, go to our website: www.fluke.com/productinfo.

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Safety Information

Warning

Read Safety Information before you use the Product.

General Safety Information is in the printed Safety Information document that ships with the Product and at www.fluke.com. More specific safety information is listed where applicable.

A **Warning** identifies hazardous conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

Static Awareness

Semiconductors and integrated circuits can be damaged by electrostatic discharge during handling. This notice explains how to minimize damage to these components.

1. Understand the problem.
2. Learn the guidelines for proper handling.
3. Use the proper procedures, packaging, and bench techniques.

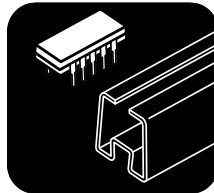
Follow these practices to minimize damage to static sensitive parts.

Warning

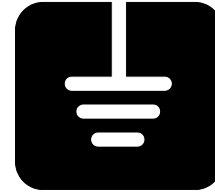
To prevent electric shock or personal injury. De-energize the product and all active circuits before opening a product enclosure, touching or handling any PCBs or components.



- Minimize handling.
- Handle static-sensitive parts by non-conductive edges.
- Do not slide static-sensitive components over any surface.
- When removing plug-in assemblies, handle only by non-conductive edges.
- Never touch open-edge connectors except at a static-free work station.



- Keep parts in the original containers until ready for use.
- Use static shielding containers for handling and transport.
- Avoid plastic, vinyl, and polystyrene foam in the work area.



- Handle static-sensitive parts only at a static-free work station.
- Put shorting strips on the edge of the connector to help protect installed static-sensitive parts.
- Use anti-static type solder extraction tools only.
- Use grounded-tip soldering irons only.

Specifications

Accuracy

Accuracy is specified for 1 year after calibration at operating temperatures of 18 °C to 28 °C, relative humidity a 0 % to 75 %. Accuracy specifications take the form of: \pm ([% of Reading] + [Number of Least Significant Digits]).

Function	Range	Resolution	Accuracy				
			301A	301B	301C	301D	301E
\tilde{V} AC Volts (45 Hz to 400 Hz)	600.0 V	0.1 V	1.5 %+5				
Voltage Frequency (Hz) 1 Hz to 99.99 kHz Threshold 10.0 V	9.999 Hz	0.001 Hz	0.1 %+3				
	99.99 Hz	0.01 Hz					
	999.9 Hz	0.1 Hz					
	9.999 kHz	0.001 kHz					
	99.99 kHz	0.01 kHz					
\bar{V} DC Volts	600.0 V	0.1 V	1 %+5				
Ω Resistance Continuity Threshold: 30 Ω	600.0 Ω	0.1 Ω	1 %+5				
	6.000 k Ω	0.001 k Ω					
	60.0 k Ω	0.01 k Ω					
⎓ Capacitance	9.999 μ F	0.001 μ F	2 %+5				
	99.99 μ F	0.01 μ F	5 %+5				
	999.9 μ F	0.1 μ F	5 %+5				
⎓ Diode	3.000 V	0.001 V	10 %				
\tilde{A} AC Current A (45 Hz to 400 Hz)	40.00 A ^[2]	0.01 A	2 %+10	NA	NA	NA	NA
	400.0 A	0.1 A	2 %+5	NA	NA	NA	NA
	60.00 A ^[2]	0.01 A	NA	2 %+10	2 %+10	2 %+10	2 %+10
	600.0 A	0.1 A	NA	2 %+5	2 %+5	2 %+5	2 %+5
	1000 A	1 A	NA	NA	2 %+5	NA	2 %+5
AAC Frequency (Hz) Threshold 10.00A	45.0 Hz to 400.0 Hz	0.1 Hz	0.1 %+3				
\bar{A} DC Current ^[1]	60.00 A ^[2]	0.01A	NA	NA	NA	2 % +10	
	600.00 A	0.1 A	NA	NA	NA	2 % +5	
	1000 A	1 A	NA	NA	NA	NA	2 % +5

[1] After zero operation.
[2] <1 % range, unspecified.

General

Maximum Voltage

Between any Terminal and Earth Ground..... 300 V

Between V/Ω Terminal and COM Terminal 600 V

Display (LCD)..... 6000 counts, updates 3/sec

Battery Type..... 2 AAA IEC LR03 alkaline

Automatic Power Off 20 minutes

Temperature

Operating -10 °C to 50 °C

Storage -30 °C to 60 °C

Operating Humidity..... Non condensing (<10°C)
 ≤90 % RH (at 10 °C to 30 °C)
 ≤75 % RH (at 30 °C to 40 °C)
 ≤45 % RH (at 40 °C to 50 °C)

Altitude

Operating 2000 m

Storage 12 000 m

Temperature Coefficient..... 0.1 x (specified accuracy) /°C (<18 °C or >28 °C)

Size (L x W x H) 199 mm x 52 mm x 16 mm

Weight (with batteries)

301A/B/C..... 132 g

301D/E 154 g

Jaw Opening 34 mm

Ingress Protection (IP) Rating..... IEC 60529: IP30 non-operating

Electromagnetic Environment..... IEC 61326-1: Portable

Electromagnetic Compatibility (EMC)

International IEC 61326-1: Portable, Electromagnetic Environment,
 IEC 61326-2-2
 CISPR 11: Group 1, Class A

Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.

Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.

Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Korea (KCC) Class A Equipment (Industrial Broadcasting & Communication Equipment)

Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.

USA (FCC)..... 47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.

Safety

General	IEC 61010-1, Pollution Degree 2
Measurement	IEC 61010-1, Pollution Degree 2 IEC 61010-2-032: CAT III 300 V

Maintenance


⚠ Caution

To prevent possible damage to the Product or to equipment under test, do not use abrasive cleansers.

Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings.

Battery Replacement

⚠⚠ Warning

To prevent possible explosion, fire, or personal injury, replace the batteries when the low battery indicator () shows to prevent incorrect measurements.

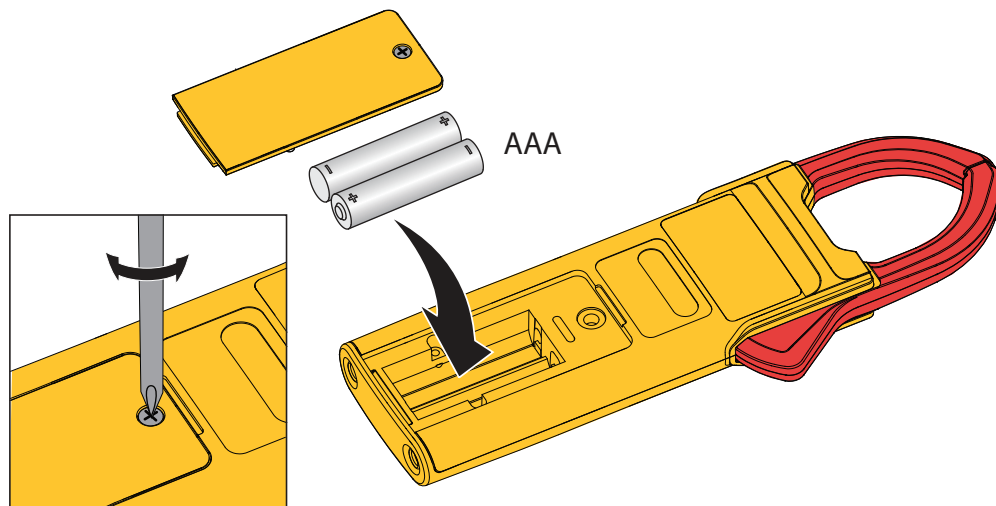
⚠ Caution

To prevent possible damage to the Product or to equipment under test:

- Remove batteries to prevent battery leakage and damage to the Product if it is not used for an extended period.
- Be sure that the battery polarity is correct to prevent battery leakage.

Figure 1 shows how to replace the battery.

Figure 1. Battery Replacement



To replace the batteries:

1. Turn off the Product.
2. Turn over the Product to access the battery compartment door screw.
3. Use a flat-head screwdriver to loosen the battery compartment door screw and lift off the battery compartment door.
4. Replace the two AAA batteries. Make sure to use the correct polarity when you put the batteries into the battery compartment door.
5. Reattach the battery compartment door.
6. Tighten the battery compartment door screw.

Jaw Maintenance

If the Product does not work properly:

1. Inspect the jaw mating surface for cleanliness. If any foreign material (including rust) is present, the jaw will not close properly and measurement errors will result.
2. Open the jaws and wipe the clamp metal ends with a non-flammable oil and cloth.

User-Replaceable Parts

[Table 1](#) is a list of the user-replaceable parts. To order parts, see [Contact Fluke](#).

Table 1. User-Replaceable Parts

Item	Quantity	Fluke Part Number
Battery AAA 1.5 V	1	5128983
Battery Door	1	5336951
TL75, Test Lead with 2 Caps	1	4306653

Product Disposal

Dispose of the Product in a professional and environmentally sound manner:

- Delete personal data on the Product before disposal.
- Remove batteries that are not integrated into the electrical system before disposal and dispose of batteries separately.
- If this Product has an integral battery, put the entire Product in the electrical waste.

Required Equipment

[Table 2](#) is a list of the equipment that is necessary for the performance tests and calibration adjustment.

Table 2. Equipment Requirements

Equipment	Required Characteristics	Recommended Model
Calibrator	4.5-digit resolution	5522A or equivalent
Wired Coil	50 turns	5500A/Coil or equivalent

Performance Tests

Warning

To prevent possible electrical shock, fire, or personal injury, do not go through the performance test procedures unless the Product is fully assembled.

The performance tests verify the full operation of the Product and measure the accuracy of each function against the Product specifications. If the Product fails a part of the test, calibration adjustment and/or repair is necessary. See [Calibration Adjustment](#).

Before you do the performance tests:

1. Make sure that you have the necessary equipment. See [Table 2](#).
2. Make sure the Product batteries are charged or replace them if necessary. See [Battery Replacement](#).
3. Warm up the Calibrator as necessary. Refer to its specifications.
4. Let the temperature of the DUT (device under test) become stable to room temperature.

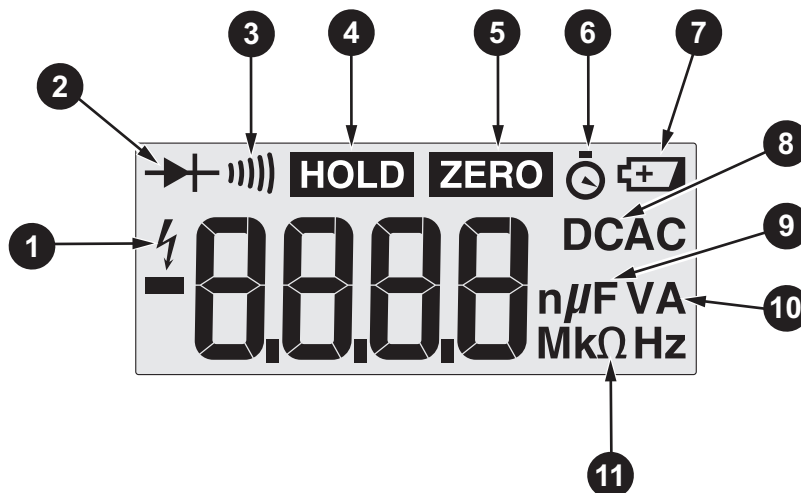
Display and Firmware Version

To verify that all segments of the display function:

1. With the Product off, push and hold **HOLD**.
2. Turn the Product on.
3. All display segments are shown. See [Figure 2](#).

If segments of the display are missing, repair is necessary. See [Contact Fluke](#).

Figure 2. Display Segments



When **HOLD** is released, the firmware current version shows, for example, **r013.F301** designates the model number.

Backlight

To verify that the backlight functions:

1. With the Product on, long press . The backlight comes on.
2. Long press again to turn off the backlight.
3. If the backlight does not function correctly, repair is necessary. See [Contact Fluke](#).

Button Test

To verify that the buttons function, turn on the Product and push each button separately. Each button push causes the Product to beep. When you push **HOLD**, **HOLD** shows on the display. If the buttons do nothing, repair is necessary. See [Contact Fluke](#).

Current

To do the current test:

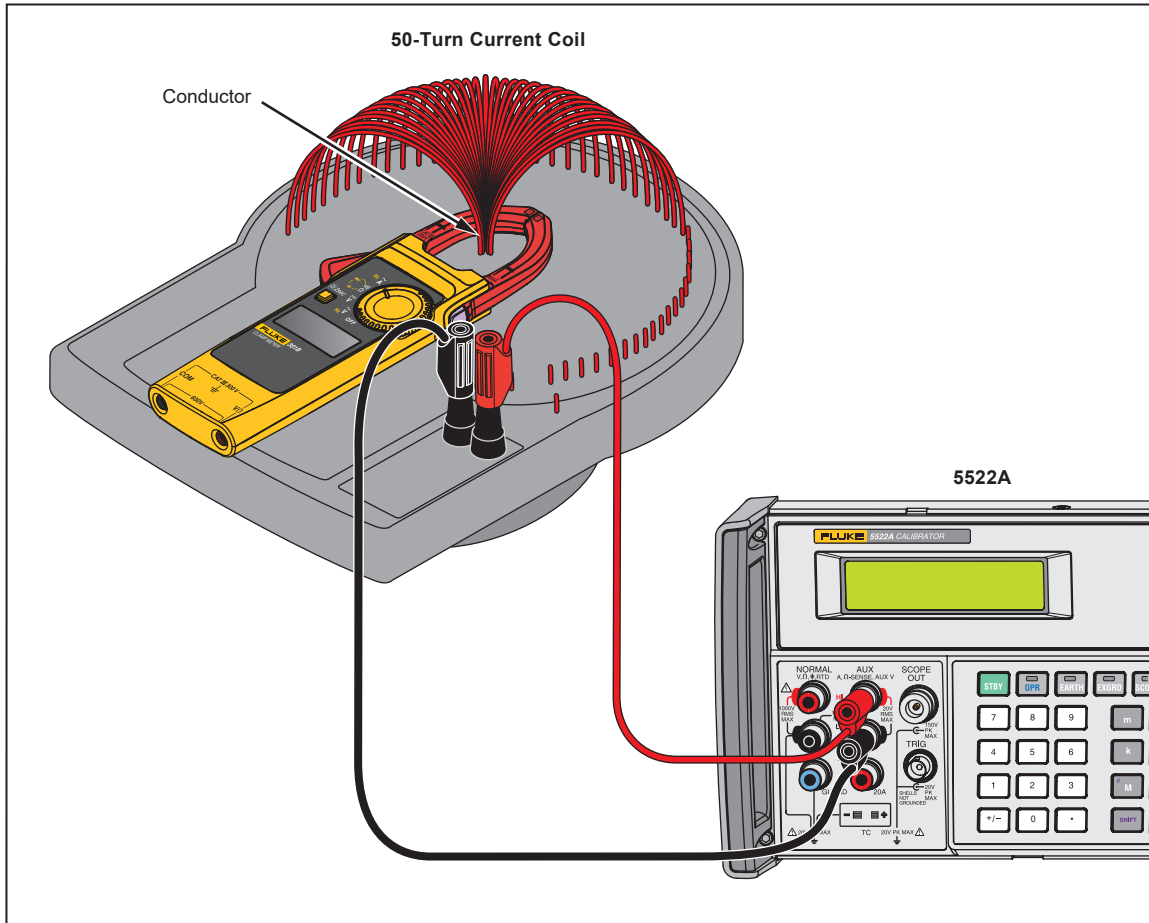
1. Connect the Calibrator Amp output and ground to the 50-Turn Coil. See [Figure 3](#) for test connections.
2. Turn the rotary switch to \tilde{A} .
3. Apply the input level for each step shown in [Table 3](#).
4. Compare the indication on the Product display with the DUT reading limits in [Table 3](#).

If the display indication is outside of the range shown in [Table 3](#), calibration adjustment or repair of the Product is necessary. See [Calibration Adjustment](#).

Table 3. Current Performance Tests

Value	Unit	Frequency or Amplitude	Res.	Spec.	Counts	301 Model					Lower Limit	Upper Limit
						A	B	C	D	E		
A ac (with 50-turn coil)												
0.2	A	50 Hz	0.01	2 %	10	•	•	•	•	•	9.7	10.3
0.8			0.01		10	•	•	•	•	•	39.10	40.90
2			0.1		5	•	•	•	•	•	97.5	102.5
8			0.1		5	•					391.5	408.5
12			0.1		5		•	•	•	•	587.5	612.5
14			1		5			•		•	681	719
19.5			1		5			•		•	951	1000
A ac, Hz (with 50-turn coil)												
45.0	Hz	0.2 A	0.1	0.1 %	3	•	•	•	•	•	44.7	45.3
400.0		3			•	•	•	•	•	399.3	400.7	
45.0		8 A			3	•	•	•	•	•	44.7	45.3
400.0		3			•	•	•	•	•	399.3	400.7	
A dc (with 50-turn coil) must zero for each point												
-16	A	0 Hz	1	2 %	5					•	-821	-779
-6			0.1		5				•	•	-306.5	-293.5
-0.6			0.01		10				•	•	-30.70	-29.30
0.2			0.01		10				•	•	9.70	10.30
1.2			0.01		10				•	•	58.7	61.3
2			0.1		5				•	•	97.5	102.5
12			0.1		5				•	•	587.5	612.5
14			1		5					•	681	719
19.5			1		5					•	951	1000

Figure 3. AC Current Test Connections



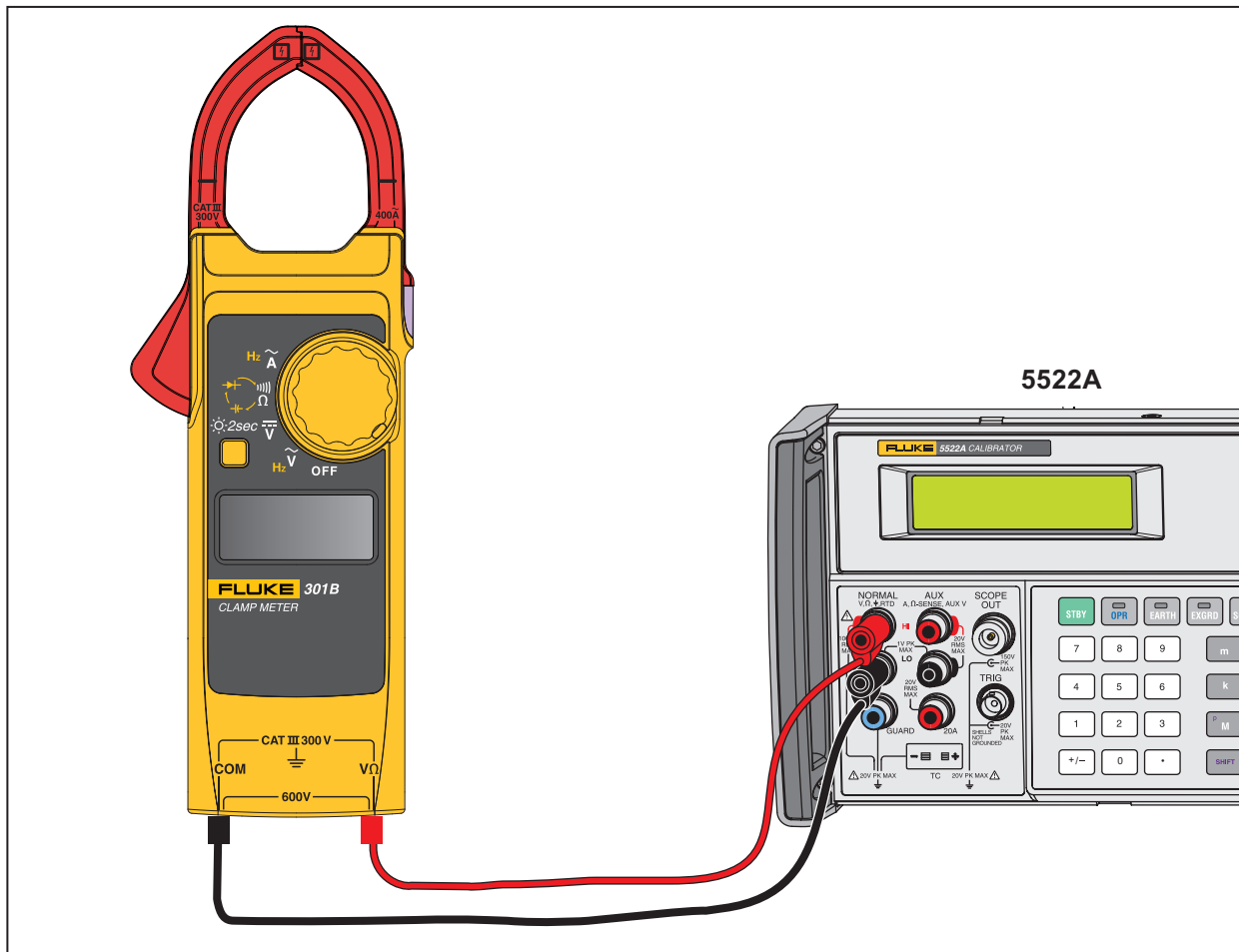
Volts and Ohms

To do the Volts and Ohms performance tests, turn the rotary switch to the necessary function and apply the values shown in [Table 4](#). See [Figure 4](#) for the test connections.

Table 4. Volts and Ohms Performance Tests

Value	Unit	Frequency or Amplitude	Res.	Spec.	Counts	301 Model					Lower Limit	Upper Limit
						A	B	C	D	E		
V ac												
20	V	20 Hz	0.1	1.50 %	5	•	•	•	•	•	19.2	20.8
10		50 Hz				•	•	•	•	•	9.4	10.7
500						•	•	•	•	•	492.0	508.0
10		400 Hz				•	•	•	•	•	9.4	10.7
500						•	•	•	•	•	492.0	508.0
Hz (V ac)												
9	Hz	10 V	0.001	0.10 %	3	•	•	•	•	•	8.988	9.012
15	Hz		0.01			•	•	•	•	14.96	15.05	
900	Hz		0.1			•	•	•	•	898.8	901.2	
1.5	kHz		0.001			•	•	•	•	1.496	1.505	
90.0	kHz		0.01			•	•	•	•	89.88	90.12	
V dc												
-10	V	0 Hz	0.1	1.00 %	5	•	•	•	•	•	-10.6	-9.4
10						•	•	•	•	•	9.4	10.6
500						•	•	•	•	•	494.5	505.5
Ohm												
0	Ω	NA	0.1	1.00 %	5	•	•	•	•	•	-0.5	0.5
10	Ω		0.1			•	•	•	•	9.4	10.6	
300	Ω		0.1			•	•	•	•	296.5	303.5	
3	kΩ		0.001			•	•	•	•	2.965	3.035	
30	kΩ		0.01			•	•	•	•	29.65	30.35	
Capacitance												
0.05	μF	NA	0.001	2.00 %	5	•	•	•	•	•	0.044	0.056
0.5			0.001	2.00 %		•	•	•	•	0.485	0.515	
5			0.001	2.00 %		•	•	•	•	4.895	5.105	
90			0.01	5.00 %		•	•	•	•	85.45	94.55	
500			0.1	5.00 %		•	•	•	•	474.5	525.5	
Diode												
0.7	V	NA	0.001	10.00 %	7	•	•	•	•	•	0.630	0.770

Figure 4. Volts and Ohms Performance Test Connections



Calibration Adjustment


The Product features closed-case calibration adjustment and uses known reference sources. The Product measures the applied reference source, calculates correction factors, and stores the correction factors in nonvolatile memory.

Should the Product fail any of the performance tests, do the calibration adjustment procedure.

For information about damage by electrostatic discharge, see [Static Awareness](#).


To do the calibration adjustment:

1. Remove the Product battery door. See [Battery Replacement](#).
2. Apply 3.0 V across the battery contacts on the PCA. Note the polarity in [Figure 5](#).
3. Turn the rotary switch to the function to **OFF**.
4. Remove the calibration seal.

5. While shorting across the CAL keypad on the PCA, turn the rotary switch to the function to adjust. See [Figure 5](#).
6. When CAL shows on the display, remove the short.
This puts the Product into calibration mode.
7. When the real value shows on the display, apply the correct input signals from [Table 5](#) to the Product. For each function, the calibration step shown on the display will advance.
8. After each step, push  on the front to confirm the calibration step, store the value, and go to the next step.
9. Set the Calibrator to Standby after you complete adjustment of each function.

Note

*If any calibration point is missing, **Err** is shown on the display.*

After you push , wait until the calibration step number advances before you change the calibrator source. Some adjustment steps can take several seconds to execute before the Product goes to the next step.

10. When calibration adjustment is complete, remove the 3.0 V supply.
The Product exits the calibration mode automatically.
11. Replace the batteries and battery door.

Figure 5. CAL Keyboard

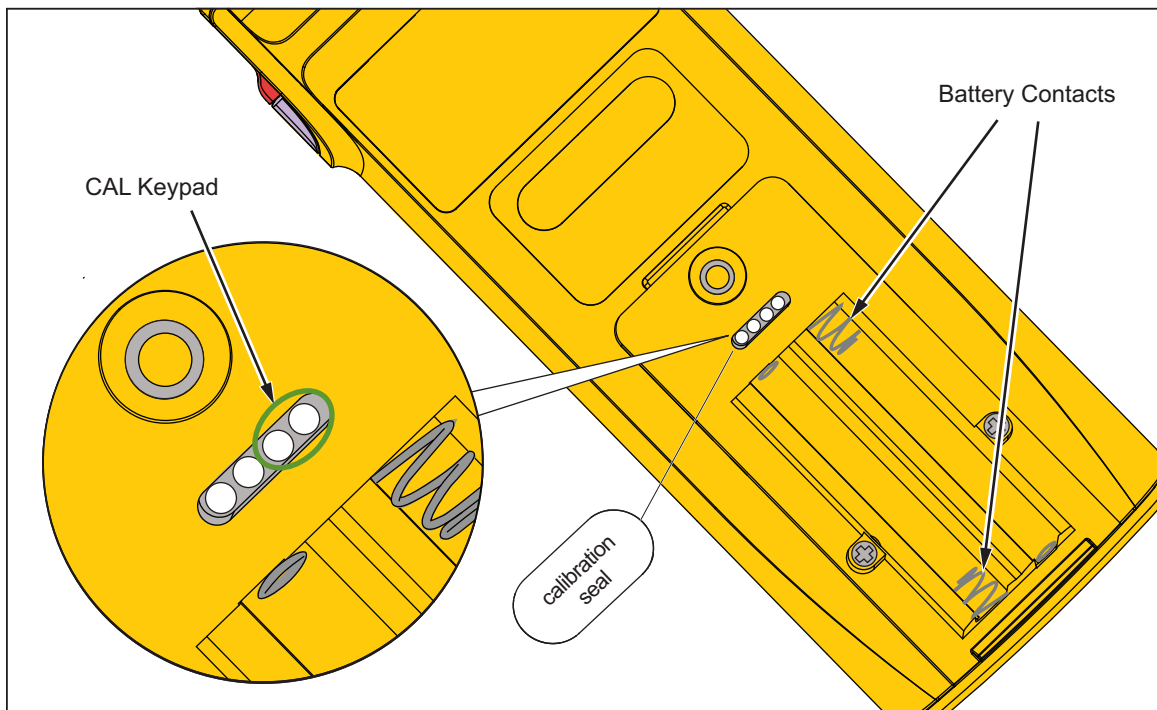



Table 5. Calibration Adjustment

RSOB Position	Value	Unit	Frequency or Amplitude	Calibration Step	301 Model				
					A	B	C	D	E
Wait for Self-Calibration until display shows MV									
	500.0	mV	0 Hz	C-1.1	•	•	•	•	•
	300.0	Ω		C-2.1	•	•	•	•	•
	50.00	k Ω		C-2.2	•	•	•	•	•
	100	nF		C-3.1	•	•	•	•	•
	50.00	μ F		C-3.2	•	•	•	•	•
	30.00	A	60 Hz	C-4.1	•	•	•	•	•
	300.0	A		C-4.2	•	•	•	•	•
	800	A		C-4.3			•		•
	0.00	A	0 Hz	C-5.1				•	•
	30.00	A		C-5.2				•	•
	0.0	A		C-5.3				•	•
	300.0	A		C-5.4				•	•
	0	A		C-5.5					•
	800	A		C-5.6					•
	\bar{V}	300.0	V	0 Hz	C-7.1	•	•	•	•
\tilde{V}	300.0	V	60 Hz	C-7.2	•	•	•	•	•